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AIR QUALITY MONITORING REPORT

PINCHER CREEK AREA

MARCH 1, 1980 TO MAY 31, 1980

Alberta
ENVIRONMENT

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PINCHER CREEK AREA
AIR QUALITY SURVEY

MARCH 1 TO MAY 31, 1980

prepared by

Air Quality Control Branch
Pollution Control Division
Alberta Environment

Edmonton, Alberta

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SYNOPIS

This report summarizes and analyses the results of the ambient air monitoring survey conducted in the Pincher Creek area from March 1 to May 31, 1980. The survey was carried out to determine whether air pollution levels resulting from gas plant emissions were linked to the health concerns of the local residents.

The findings of the survey based on the monitoring of hydrogen sulphide, sulphur dioxide, oxides of nitrogen, nitrogen dioxide, ozone, total hydrocarbons, and soiling index are:

1. The levels of all the monitored pollutants, except hydrogen sulphide and ozone, were well below the Alberta Clean Air (Maximum Levels) Regulations.
2. There is no correlation between the monitored air pollution levels and the health concerns of the residents.

The levels of hydrogen sulphide exceeded the one-hour regulation of 0.010 ppm on three occasions; however the maximum recorded concentration (0.017 ppm) was far below the levels at which health effects have been documented. Similarly for ozone, there are no documented health effects at the levels measured in the Pincher Creek area, even though the 24-hour regulation was exceeded an average of 92 percent of the monitoring period.

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1. INTRODUCTION

In response to reports by residents in the Pincher Creek area that respiratory disorders and skin rashes were associated with emissions from the gas plants in the area, Alberta Environment co-ordinated a study to determine whether there was a correlation between the observed health problems and the monitored air pollution levels.

The study consisted of two phases: (1) determination of the ambient levels of various air pollutants; and (2) determination of the selenium levels in the atmosphere and in plant emissions. Only the ambient air monitoring data are analyzed in this report. The other part of the study is dealt with in a separate report.

To measure the ambient levels of the pollutants, a mobile air monitoring trailer was located 5.8 kilometres east-southeast of the Shell Canada Resources-Waterton gas plant, and 2.5 kilometres west-southwest of the Gulf Oil Canada-Pincher Creek gas plant (Figure 1).

The objective of the survey, conducted from March 1 to May 31, 1980, was primarily to determine the ambient levels of hydrogen sulphide and sulphur dioxide, as these two pollutants are associated with the processing of sour gas. However, because of the nature of the concerns, a comprehensive air monitoring survey was carried out. In addition to hydrogen sulphide and sulphur dioxide, the oxides of nitrogen, nitrogen dioxide, ozone, total hydrocarbons, soiling index, and wind speed and direction were also monitored.

This report summarizes and analyzes the data collected during the survey and includes conclusions drawn from the analysis. The analysis of the data takes two forms. First, the data are compared with the levels outlined in the Alberta Clean Air (Maximum Levels) Regulations; and second, the health effects noted by the area residents during the survey are correlated with the corresponding measured levels of the air pollutants.

The raw data collected during the survey are collated as a supplementary report.

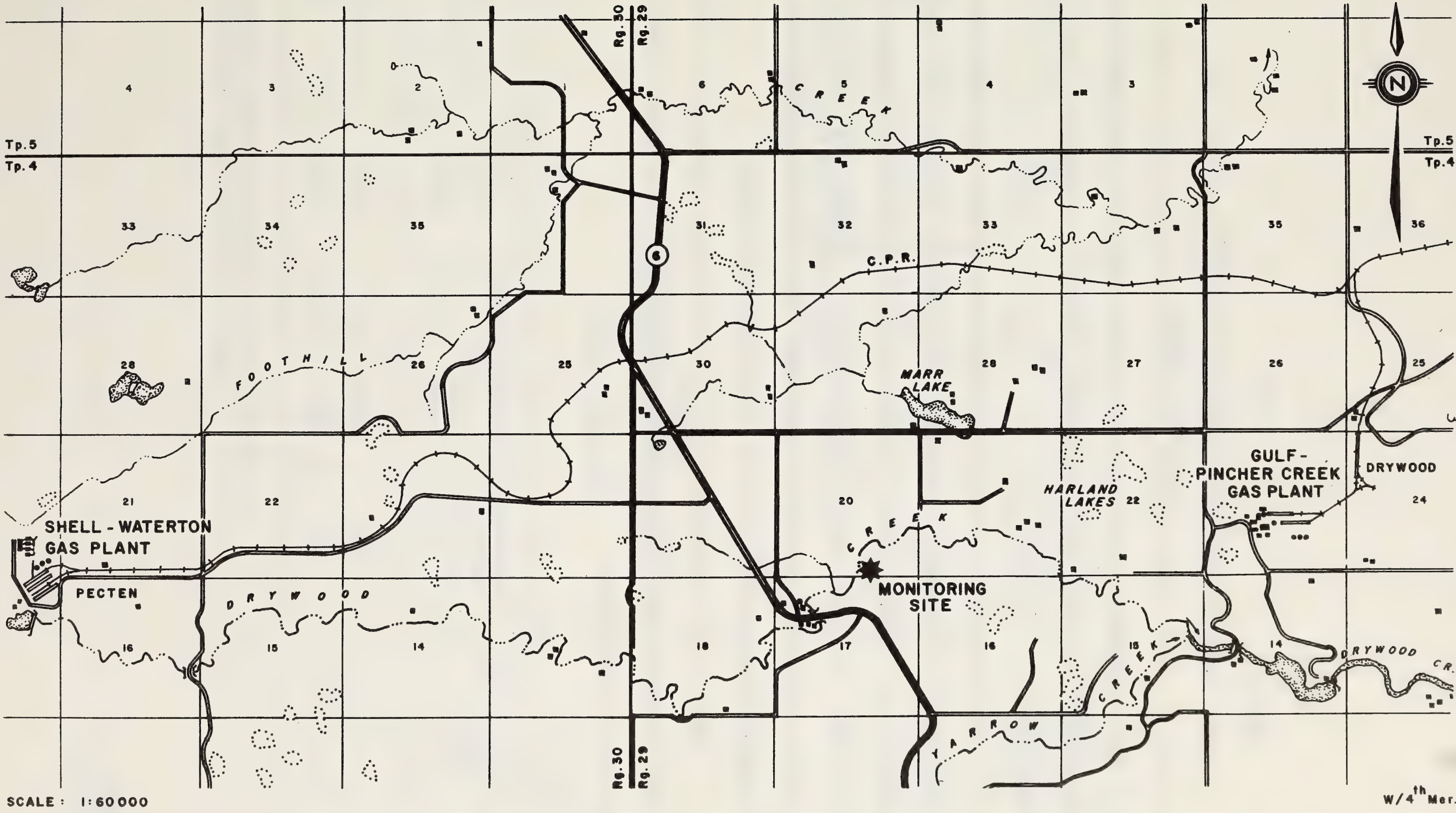

Figure I - MAP SHOWING LOCATIONS OF THE AIR MONITORING TRAILER AND GAS PLANTS

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2. RESULTS

The data collected during the period of the survey are summarized in Tables 1 to 8. Examination of the tables reveals that the levels of all the parameters, except hydrogen sulphide and ozone, were well below the levels outlined in the Alberta Clean Air (Maximum Levels) Regulations.

For hydrogen sulphide, the data indicate that there were three occurrences of readings in excess of the one-hour standard of 0.010 ppm--one in March and two in May--with levels reaching a maximum of 0.017 ppm. For ozone, hourly levels reached a maximum of 0.075 ppm (Alberta one-hour standard is 0.080 ppm), and the 24-hour standard was exceeded an average of 92 percent of the monitoring period.

Winds were predominantly from the westerly quadrant with calm winds accounting for 27.2 percent and 23.9 percent of all winds in March and April respectively.

TABLE 1

SUMMARY OF HYDROGEN SULPHIDE DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation* Exceeded	
		1-hr	24-hr		1-hr	24-hr
March '80	0.00	0.017	0.001	79.2	0.17	0.00
April	0.00	0.010	0.001	89.0	0.00	0.00
May	0.00	0.017	0.002	90.3	0.30	0.00

* Alberta Clean Air (Maximum Levels) Regulations
1-hr---0.010 ppm; 24-hr---0.003 ppm

TABLE 2

SUMMARY OF SULPHUR DIOXIDE DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation* Exceeded	
		1-hr	24-hr		1-hr	24-hr
March '80	0.00	0.03	0.00	93.5	0.0	0.0
April	0.00	0.04	0.00	89.6	0.0	0.0
May	0.00	0.01	0.00	90.5	0.0	0.0

* Alberta Clean Air (Maximum Levels) Regulations
1-hr---0.17 ppm; 24-hr---0.06 ppm

TABLE 3

SUMMARY OF TOTAL OXIDES OF NITROGEN DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation Exceeded	
		1-hr	24-hr		1-hr	24-hr
March '80	0.01	0.03	0.02	98.7	No Regulation	
April	0.02	0.08	0.03	98.7		
May	0.01	0.06	0.03	95.0		

TABLE 4

SUMMARY OF NITROGEN DIOXIDE DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation* Exceeded	
		1-hr	24-hr		1-hr	24-hr
March ' 80	0.00	0.02	0.01	98.7	0.0	0.0
April	0.00	0.01	0.01	98.7	0.0	0.0
May	0.00	0.03	0.00	95.0	0.0	0.0

* Alberta Clean Air (Maximum Levels) Regulations
1-hr---0.21 ppm; 24-hr---0.11 ppm

TABLE 5

SUMMARY OF OZONE DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation* Exceeded	
		1-hr	24-hr		1-hr	24-hr
March '80	0.038	0.050	0.045	99.3	0.0	97.4
April	0.041	0.060	0.049	99.6	0.0	97.1
May	0.038	0.075	0.060	98.9	0.0	81.5

* Alberta Clean Air (Maximum Levels) Regulations
1-hr ---0.080 ppm; 24-hr---0.025 ppm

TABLE 6

SUMMARY OF TOTAL HYDROCARBON DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (ppm)	Maximum Readings (ppm)		Percentage of Time Instrument Operational	Percentage of Time Regulation Exceeded	
		1-hr	24-hr		1-hr	24-hr
March '80	2.0	3.0	2.3	85.3	No Regulation	
April	2.0	2.5	2.2	87.1		
May	1.8	3.2	2.1	70.3		

TABLE 7

SUMMARY OF SOILING INDEX DATA

PINCHER CREEK AREA

Monitoring Period	Arithmetic Mean (COH)	Maximum Readings (COH)		Percentage of Time Instrument Operational	Percentage of Readings greater than 1.0 COH*
		1-hr	24-hr		
March '80	0.01	0.60	0.07	100	0.0
April	0.01	0.20	0.05	99.9	0.0
May	0.04	0.60	0.14	99.6	0.0

* Alberta Environment guidelines require that no more than 10% of the readings should be greater than 1.0 COH (Coefficient of Haze)

TABLE 8

FREQUENCY DISTRIBUTION OF WIND

PINCHER CREEK AREA

Monitoring Period	WIND DIRECTION (percent frequency)									Percentage of Time Instrument Operational
	Calm	N	NE	E	SE	S	SW	W	NW	
March '80	27.2	4.2	8.3	4.7	0.3	0.5	25.5	27.2	2.2	100
April	23.9	5.8	5.6	5.1	0.6	0.6	18.9	24.3	3.5	88.2
May	3.5	3.1	5.9	7.8	7.4	1.6	6.9	14.1	8.1	58.3

3. DATA ANALYSIS

From the data shown in Tables 1 to 7, it is apparent that the only pollutants that are noteworthy are hydrogen sulphide and ozone as the monitored levels of these two pollutants exceeded the Alberta regulations.

3.1 HYDROGEN SULPHIDE

Hydrogen sulphide (H_2S) is often a component of natural gas. Therefore, ambient levels of H_2S in the vicinity of a gas processing plant can originate from a number of sources. Small leaks from sources such as well and battery sites can contribute to the total H_2S emissions.

In the Pincher Creek area, no specific source was identified. However, on one occasion when the Alberta Regulation was exceeded the Gulf-Pincher Creek plant had experienced a raw condensate spill.

Although the current literature indicates that the primary effects of H_2S on health are related to the respiratory system, the concentrations measured in the Pincher Creek area were well below the documented levels (50 ppm to 100 ppm) which elicit such responses. Furthermore, the documented problems of area residents during the survey: diarrhoea, wheezing and coughing, and skin rashes, show no correlation with the H_2S levels. These problems recurred throughout the survey period even when no H_2S was detected.

3.2. OZONE

Ozone in the atmosphere results from two distinct sources: the stratosphere--a natural source of ozone, and photochemical oxidation involving the nitrogen oxides and hydrocarbons. The determination of the source of ozone is usually based on the diurnal patterns of variation of ozone concentration. Patterns with little or no variation in the ozone concentration are indicative of a natural source, whereas patterns which show extreme diurnal variation indicate photochemical production of ozone.

An analysis of the ozone data collected during the first month of the survey indicated that there was very little or no variation in the diurnal pattern. Based on this observation, the Alberta Environment interim report concluded that the concentrations of ozone measured in the Pincher Creek area were of natural origin. However, analysis of the data for the three-month period of the survey indicates that there is variation in the diurnal pattern (Figure 2). Hourly levels ranged from 0.035 ppm at night to a peak of 0.047 ppm from 15:00 hours to 17:00 hours. The observed ozone levels are therefore a result of photochemical oxidation.

Although the pattern indicates photochemical production of ozone, it would appear that the gas plants are contributing minimally to this process, as the monitored levels of the nitrogen oxides and hydrocarbons were quite low.

The effects of ozone on human health have usually been difficult to document because of the wide variation in response among individuals. However, new information on the health effects of short-term exposure have emerged from controlled studies on humans. The data show an increase in the frequency of headaches and chest discomfort at and above hourly concentrations of 0.25 to 0.29 ppm. The frequency of eye irritation, however, increased as daily maximum hourly levels exceeded 0.15 to 0.19 ppm.

As yet, there seems to be little information detailing the observed health-related effects for 24-hour exposures. Therefore, no inference as to the effects of the 24-hour concentrations measured in the Pincher Creek area can is made. However, as the one-hour levels measured in the Pincher Creek area were below the 0.15 to 0.19 ppm range, none of the observed health effects can be attributed to ozone.

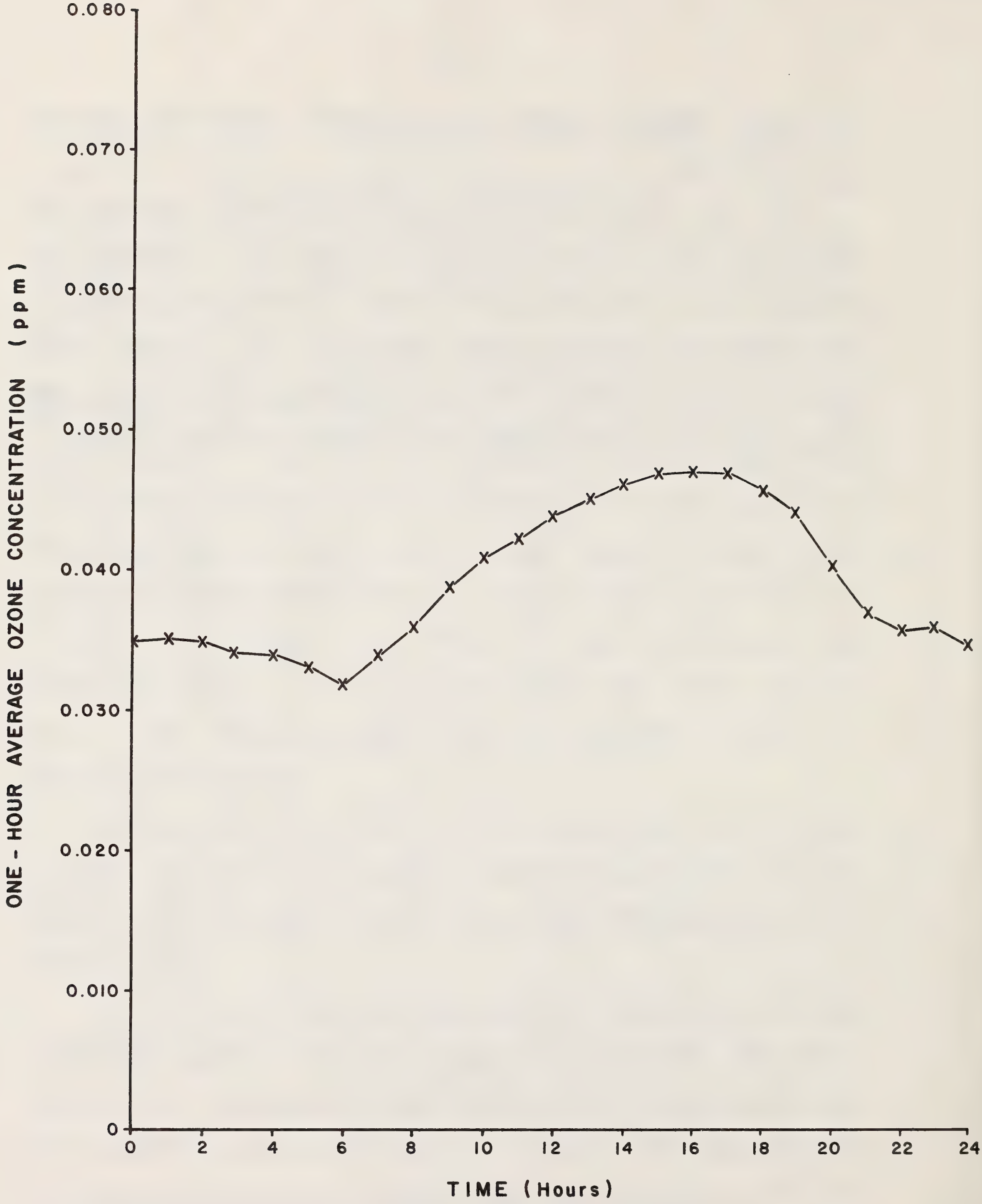

Figure 2 – DIURNAL VARIATION OF OZONE LEVELS IN THE PINCHER CREEK AREA (March 1 - May 31, 1980)

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4. CONCLUSIONS

The results of the ambient air monitoring survey in the Pincher Creek area have shown no correlation between the monitored air pollution levels and the observed health problems of area residents. This determination is based on health effect criteria which describe the effects that have been observed when a pollutant reaches a known concentration in the ambient air.

In the Pincher Creek survey, two pollutants--hydrogen sulphide and ozone--exceeded the Alberta regulations. However, the health effect criteria for both pollutants indicate that there are no adverse effects on human health at the levels monitored in the Pincher Creek area.

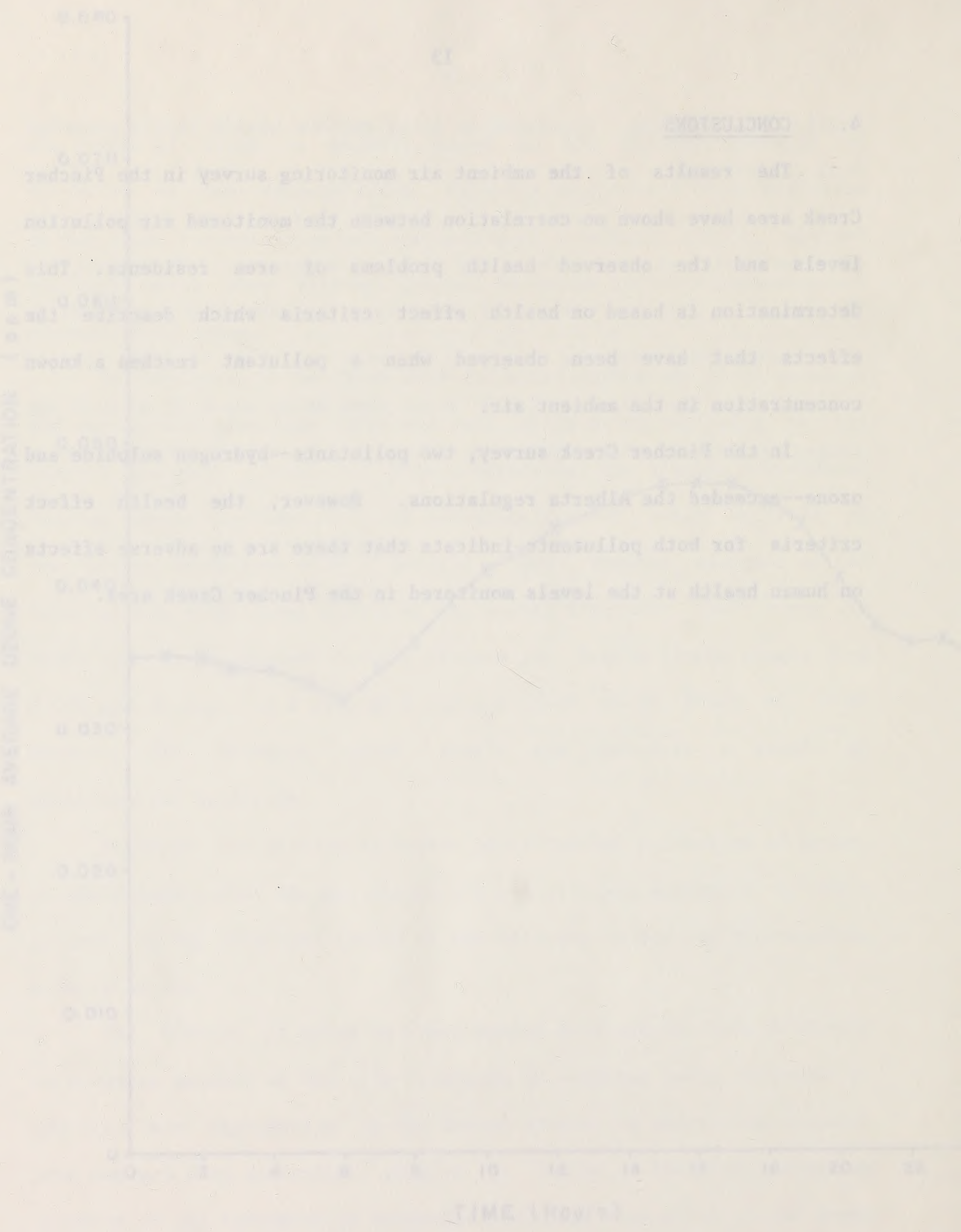

Figure 2 – DIURNAL VARIATION OF OZONE LEVELS IN TH
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